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Ocean Acoustics

The Sound of the Ocean

Comprehensive long-term study on ambient sound in the Southern Ocean published

[12. January 2017] **For nearly three years, AWI researchers used underwater microphones to monitor the Southern Ocean and listen to a "choir" of whales and seals. The sounds recorded offer new insights into the ocean's natural soundscape, as well as the animals' behaviour and distribution.**

In the world's oceans, it is never completely silent; above all, the action of wind and waves produces a continuous ambient sound. In some areas human activities, e.g. shipping or the use of resources, produce additional sounds that, depending on the distance, can drown out the natural ambient sound. In this regard, the Antarctic represents a major exception to the rule, since its remote location has left it largely untouched from an acoustic standpoint. As a result, no other ocean on the planet is as well suited for an acoustic study on marine mammals and the natural underwater ambient sound as the Southern Ocean. Researchers from the Ocean Acoustics Working Group at the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI) spent nearly three years recording the unique underwater soundscape of the Antarctic. Their findings were recently published in the journal *Royal Society Open Science*.

Sebastian Menze, first author of the study, and his colleagues identified sounds produced by various species in the Southern Ocean, including leopard seals, Antarctic blue whales, fin whales and Antarctic minke whales, which blend into a set of background "choruses" that contribute to the ambient sound. The intensity of these contributions varied with time and location, yielding new insights into the animals' behaviour and distribution.

For example, the sound contributed by Antarctic minke whales followed a 24-hour rhythm in the winter months from April to July, indicating that these whales vocalize more frequent at night than during the day. This is likely related to the fact that krill, their main prey species, migrate vertically in an identical day-and-night rhythm. Further, the researchers gathered data on the animals' annual cycle: Antarctic blue whales contribute to the ambient sound year-round, while fin whales and Antarctic minke whales only do so for a few months.

In addition, the marine biologists and physicists were able to determine the extent to which sea ice influences the soundscape of the Southern Ocean. During the winter months, it covers the ocean like a muffling blanket: "In the Antarctic, it's impressively quiet under the sea ice cover. Not only physical phenomena such as storms and waves are the main sources of ambient sound, but also marine mammals", explains Sebastian Menze. The acoustic recordings show that not only the extent of the sea ice is important, but also its concentration and thickness.

The researchers used two recorders, which they moored at depths of 217 and 260 metres in the Atlantic part of the Southern Ocean from March 2008 to December 2010. Their work represents the first long-term study on

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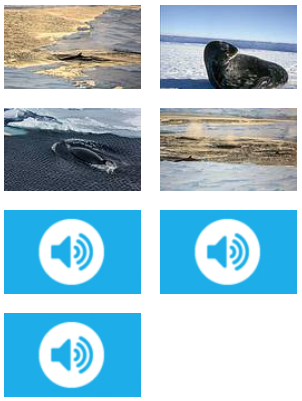

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underwater ambient sound conducted in the higher latitudes of the Southern Ocean. “As a rule, comparable studies only cover a few weeks in Antarctic summer,” Menze relates. “Especially when it comes to the seasonal changes in marine mammal distribution, there are still many open questions, some of which our recordings can answer.”

Original publication

Sebastian Menze, Daniel P. Zitterbart, Ilse van Opzeeland, Olaf Boebel: *The influence of sea ice, wind speed and marine mammals on Southern Ocean ambient sound.* January 2017. DOI: 10.1098/rsos.160370

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